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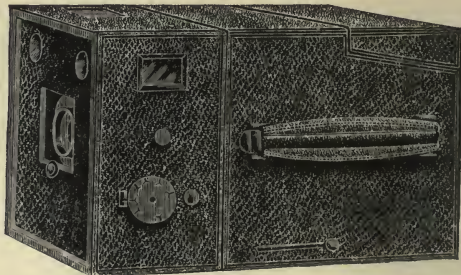
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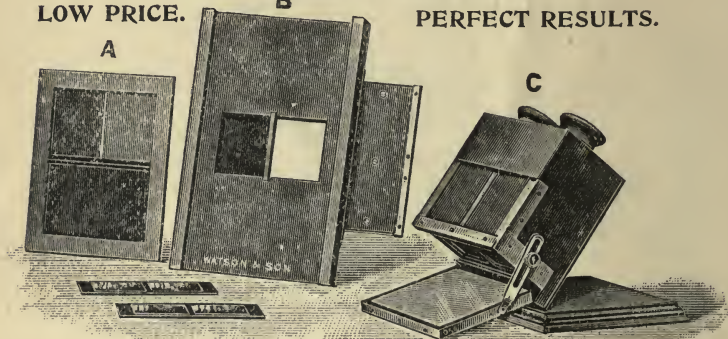
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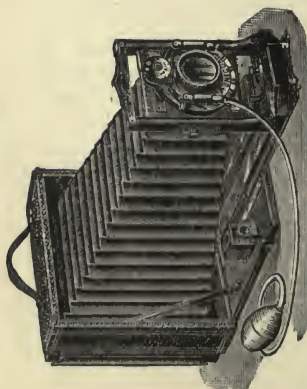
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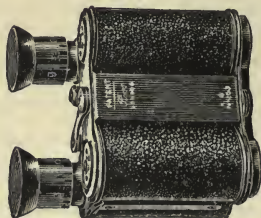
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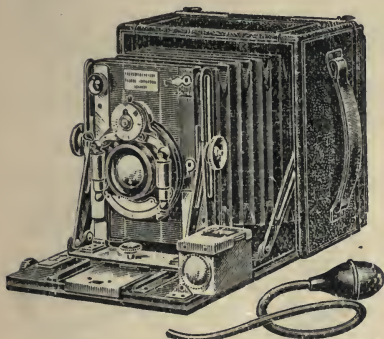
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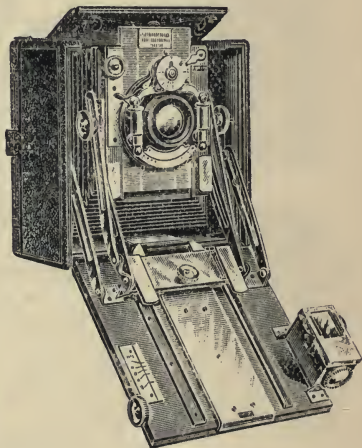
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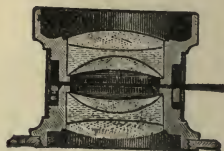
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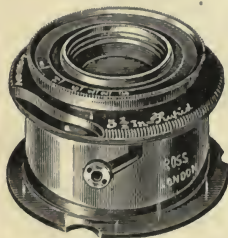
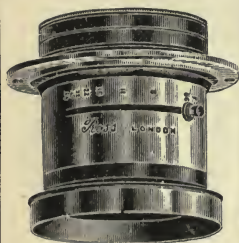
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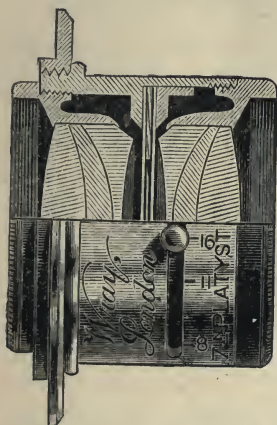
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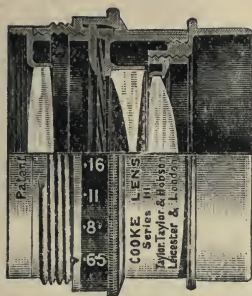
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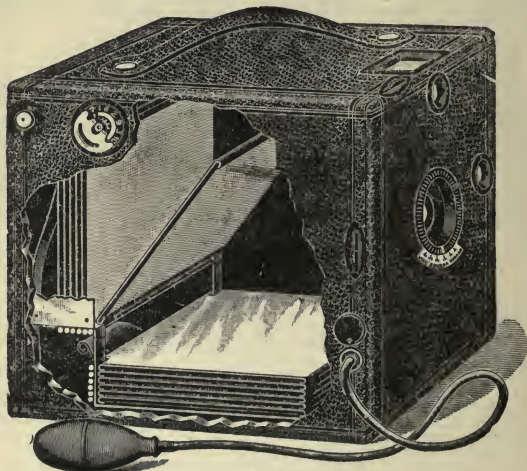
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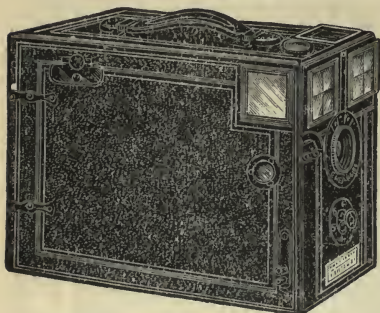
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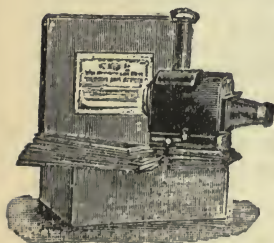
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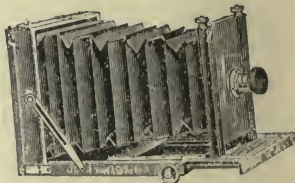
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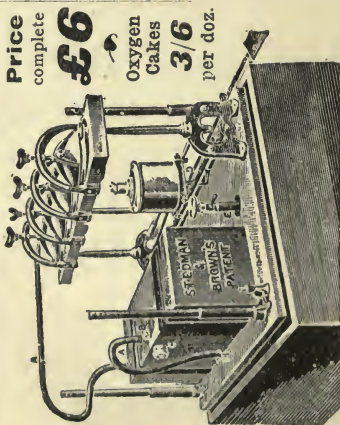
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OR

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BY
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PHOTO-AQUATINT;

OR,

THE GUM BICHROMATE PROCESS OF PRINTING IN PIGMENT WITHOUT TRANSFER.

CHAPTER I.

PRELIMINARY OBSERVATIONS.

A NEW method of printing which has attracted considerable attention at recent exhibitions of the Photographic Salon is destined in all probability to exercise an important influence upon the future of pictorial photography.

If not altogether new in principle it is so in its application, for the very qualities which caused it to be cast aside at the time of its original inception as worthless, or at least impracticable, are those towards which the feeling of modern art in photography is undoubtedly tending.

Inquiries concerning the method of production of the prints in bichromated pigment without transfer which have been exhibited at the last three exhibitions of the Photographic Salon have been so numerous that it has been thought that a description of the process would prove of value to those who desire to work it.

The object of these papers will be to examine briefly the historical aspects of the question, to show the distinctive qualities and value of the new method of treatment, and to give concise directions concerning the preparation of the paper, the materials employed, and the methods of using them. Some notes also will be added on the subject of similar systems, such as the *papier velours* or direct printing in carbon, known as the Artigue process.

Until quite recently, the quality desired by all photographers alike, whether for scientific or for pictorial purposes, was a printing medium which should reproduce in its minutest details, and with the greatest fidelity to the varying degrees of gradation, a counterpart or positive image of the negative. There was no distinction made between work which was intended for scientific exactness and that which aimed at artistic ends. Whatever retouching, or working upon, the negative might receive, no such liberty of modification was considered lawful in the case of the resulting print. The effect of light acting mechanically through the various densities, aided though it might be by skilful manipulation, or hand work, upon the negative, was to be alone responsible for the ultimate result. Possibly the very difficulty of altering the deposit on the printing surfaces, which in nearly all cases is the result of chemical reactions, was to some extent a reason for the continued conservatism. Besides this, there was the fast-rooted prejudice in favour of glossy and brilliant surfaces, and it was not until the fashion changed, and rough papers came in, that departures were tolerated in the direction of a less faithful reproduction in counterpart of the original image. Some of the earliest and most radical innovations in this respect were perhaps

those which permitted selective development when cold-bath platinotype was introduced. With this paper, by means of the staying action of glycerine and other devices, it may be said that any amount of modification, from absolute obliteration to varying degrees of depth of half tone and shadow, is possible, and in the most skilled hands not impracticable.

That general feeling amongst those photographers who devote themselves to pictorial work is distinctly in favour of the utmost latitude in modification is hardly to be denied. The growth of such a feeling has been gradual indeed—so gradual that the transition has come about almost without our being aware of it, but it is unquestionable that methods and practices which were held in horror but a very few years back are now not only tolerated but encouraged. That the advocates of what is erroneously called pure photography may be shocked and displeased is probable, but they cannot stop the flowing tide. With the growth of pretensions towards individuality as opposed to mechanism, towards evidence of personal artistic feeling as opposed to uncontrolled machine-made pictures, it would seem that as a pictorial process pure photography no longer suffices to satisfy. It had arrived perhaps at its acme, proficiency in attaining that standard had become comparatively easy, and there was no alternative to monotonous correctness but a latitude and freedom in treatment which should set up a type of excellence to be judged on other grounds than that of mere dexterity.

The prevailing idea of photographic exhibitions in former days was that they were organised chiefly for the instruction and encouragement of the photographer. The outside public in search of the beautiful was scarcely considered at

all. Hence it was that an important feature in the catalogue was the description of the processes employed, and visitors were supposed to be greatly interested in knowing whether the results shown were due to purely mechanical means, or whether the personal agency of the worker had been employed to modify them. Nowadays an exhibition of pictorial photography is addressed in a greater degree to the general art-loving public, which neither knows nor cares how the various processes of photography have been applied to produce the picture, but is interested only in the beauty or otherwise of the result. With this change of idea the encouragement of the inexperienced amateur by means of medals and awards obviously also falls to the ground. It is beginning to be understood that visitors to exhibitions are really not in the least interested in the opinion of two or three gentlemen, and the laurels they may bestow on a certain number of exhibits which they may consider to be better than others. What the visitor goes for is to find subject for admiration, and also in many cases to buy. The Photographic Salon was the first to encourage purchases, and it is due to its exhibitions that the present high prices are given. This is indeed a very tangible evidence of public feeling. It is for the public to judge. If it does not approve the results which may be produced they will become of no value and drop out of the race. At the present moment it is undoubtedly in sympathy with the new order of ideas.

In reviewing the revolutionary spirit which appears to prevail in modern pictorial photography, we are insensibly led to the consideration how far a method which professedly gives a great latitude to the worker may be said to be

legitimate, if we still wish to preserve the spirit of photography ; that is to say, whether the epithet *faking* may be more justly applied in an adverse sense than in the case of other practices in the production of prints and negatives which are universally allowed. A full examination of the arguments on either side, which have been so frequently debated, would lead us for the moment too far, and we propose to revert to this question in our concluding chapter. But it is at least reasonable to point out that we ought to be logically consistent, and it would be illogical to condemn practices which may be used with advantage in photo-aquatinting, and at the same time to condone similar methods of which all photographers avail themselves.

CHAPTER II.

A BRIEF HISTORICAL RETROSPECT.

THE earliest notions of the properties of light on bichromates in contact with organic matter appear to have started with Vauquelin at the end of last century. In 1839 and 1840 Mungo Ponton and Becquerel certainly produced prints, the latter using starch, with which, in combination with iodine, he obtained a fine blue colour; and in 1853 Fox Talbot, and after him Pretsch and Poitevin, appear for the first time to have utilised the action of bichromate in rendering gelatine insoluble after exposure to light.

We get nearer to our most modern system in the results obtained by Poitevin, and in him we must recognise the first who printed by means of bichromated gum or gelatine, in which he put coloured matters. There is a long distance, however, from the discoverer of the power of steam in a boiling kettle to the inventors of the steam engine and railway system, and so we have to acknowledge the important modifications of Swan as having had the most influence on the system of carbon or autotype printing, which has obtained (in its perfection, it may be said) for now over thirty years. The name of Pouncy must also be mentioned, not only as a pioneer, but as one whose process, similar to that of Poitevin, and perhaps derived from it, is, in essentials, the system of gum-bichromate printing or *Aquatint*, which we propose to fully describe in these papers.

In connection with the general subject a brief note must suffice to allude to the kindred system known as the powder or dusting-on process, in which the colouring matter is applied to the chromated film after exposure. This method was known to Poitevin, and appears first to have been practically used in France about the year 1858.

Exhibitions were not so common in days gone by as they are now, and the results of the work of those we have mentioned and of others were shown probably at meetings of learned societies. Carbon prints produced by the Swan or transfer system reigned supreme afterwards at the leading exhibitions for many years, and it was not until attention was drawn to the error of the hitherto universally accepted teaching that the film could only be successfully attacked for purposes of development *from the back*, and the absolute proof of the error by the introduction of Artigue's *papier velours*, that pictures by the revived and perfected system began to be shown. Mr. Rouillé-Ladevèze was the first to exhibit pictures on hand-coated paper at the exhibition of the Photo Club de Paris in 1894, and at the London Salon of that year the same pictures were shown, and with them others by the writers of these papers. The beautiful results obtained on Artigue paper by Monsieur Puyo, at the same time, astonished and puzzled the *quid-nuncs*, and at the exhibitions of the two following years not only were there several other pictures by the direct method (some detected and others passing unsuspected as platinotype or ordinary carbon work), but even at the exhibition of the Royal Photographic Society very perfect examples on Artigue paper contributed to clench the demonstration of the fallacy that development by transfer was an absolute necessity if

the half tones were to be retained. The dogma will no doubt disappear in new editions of the text-books, and no longer form the opening remark at lectures. It has died hard, however, and, to the last, photographic scientific writers of eminence, or at least of prominence, have continued to deny that an error has been involved. It is perhaps, after all, only a question of terms. For ourselves we are content unhesitatingly to assert that bichromate or carbon paper can be coated and developed directly from the front, and is capable of giving in this manner the most delicate half-tones, equal in every respect and superior in some, to those which can be made by the transfer system. And this is the exact contrary to what has been taught until recently. The case was oddly enough a repetition of the famous problem concerning a fish in a globe of water which King Charles propounded to his philosophers, but a strange one in the present days of universal investigation.*

As we propose to go little into the theory of the subject, we need only briefly allude, for the information of those to whom it is altogether new, to the underlying principle of all systems of colloid bichromate printing. This principle resides in the fact that if a mixture of a bichromate salt in solution and some colloid substance—such as, for instance, gum, gelatine, or starch—is prepared and applied to the surface intended to hold the impression, such parts as are allowed to be acted upon by light become insoluble in proportion to the amount of light acting upon them and are fixed on the support, the unaltered portions

* Artigue paper was first publicly demonstrated in 1889, some years previous to an American system described in the photographic journals which was copied from it. It was practically unknown in England until 1894.

remaining capable of being washed or dissolved away. If we add a colouring matter to the mixture this also will, of course, remain on the support. It follows, therefore, that we may, for example, coat a piece of paper with a mixture say, of gum, bichromate of potash, and red ochre. We may then place this prepared paper under a negative through which, on exposure, the light will act in varying degrees according to the nature of the negative image. The unacted on portions being then dissolved away in water, a positive or counterpart appears, and the free bichromate being removed the colouring matter remains attached to the paper, held there by the insolubilised gum, thus forming an inalterable picture, as permanent as the paper or support on which it lies.

CHAPTER III.

MATERIALS USED IN THE PROCESS.

THE PAPER, THE GUM AND SENSITISING SOLUTIONS, COLOURS,
BRUSHES, ETC.

IT must be borne in mind that in the preparation of the paper which we are about to describe, the characteristic at which we are aiming is not that of such a film as is deposited by Artigue's process. With the latter undoubtedly an extreme delicacy of half-tint and certain admirable, though quasi-mechanical, qualities can be obtained. Treated in the ordinary way, the reproduction from a negative is, on Artigue's papier velours, as mechanical an operation, and one which may be as rapidly carried out, as any other printing-by-development process. It is amenable certainly to various modifications, but with these we need not occupy ourselves for the moment. The charm and principal value of a printing medium prepared in the manner which we shall describe are in the adaptability by the artist himself to his moods and requirements. There will always remain with each worker a special character of his own. One may prefer to assimilate and make the most of this or that quality, another of another; and so numerous are the modifications which may be made that probably no two men will ever work exactly alike, nor is it even perhaps possible so precisely to follow a method previously used as to produce

an absolute replica. To some photographers, no doubt, this lack of automatic character and difficulty of making two prints alike is a drawback which should condemn the process entirely rather than constitute a quality to be admired. To others the freedom and personality of treatment are its essence and its beauty. It has other qualities also—a certain mellowness, and a softness of the outlines due to the behaviour during development of the constituents used—which have led us to prefer the simple method of preparation which we shall describe to any more complicated ones, or to the substitution or admixture of gelatine or other colloids instead of gum alone.

It is hardly necessary to say that prints by the gum-bichromate process are permanent—that is, they will last as long as the paper on which they are printed. The single chemical substance used in their preparation is easily eliminated, so that there is no reason for any colour-fading unless the pigment used has been chosen amongst the non-permanent ones. The surface of the print is softer and less glossy than in the usual carbon process. The pigments are chosen and mixed by the worker himself, and by changing their relative proportions an infinity of different shades of colour can be obtained. No transfer is necessary; there is no blistering of the film, for there is practically no film to blister; no chemicals are used in developing, but water alone, and that also (in normal cases) at an ordinary temperature instead of at different degrees of heat. Once developed and cleared, a gum bichromate print is composed of an irregular layer of colour held on the surface of the paper by just sufficient insoluble gum arabic. It is, in fact, a water-colour, and it is in order to give it a distinguishing

name, which shall be applicable at least to its most simple qualities, that we have called it photo-aqua tint.

THE PAPER.—Any sort of paper which is sufficiently sized to prevent the soaking of the pigmented mixture into the pores of the paper will do. It is of the first importance that the image should be kept sufficiently on the surface, and this is also the function of the gum in the mixture to assist in doing, as we shall show when treating of the method of coating. It must also have sufficient resistance to the action of the water used in developing if, as is sometimes necessary, this has to be used at a comparatively high temperature. In the choice of paper there is practically an unlimited field, and the worker has at his disposal a large range of power in the production of the effects at which he may be aiming. Japanese and Chinese-India papers cannot be easily coated. The colour sinks, and the loose fibres of the paper are detached by the friction of the brush, and cause smears. They are, moreover, so loose and soft in texture as not to be able to support the action of the water in washing up. In any case the pigment must not be allowed, while coating, to sink beneath the surface into the body of the paper. Once there it stays, and no amount of washing during development will remove it.

The final aspect of the picture is greatly modified by the different grain of various papers, in the same way as with other processes. Thus, coarse-grained, rough papers give diffusion and loss of detail, with a power of opening up the shadows; smooth papers give detail and sharpness. As a rule, perfectly smooth papers, such as Rive, are the most difficult to coat evenly. The coloured mixture finding no

asperities to cling to, and following the brush instead of settling on the paper, obliges the worker to prolong the operation, and thus assumes a semi-adhesive consistency productive of ridges, which cannot be smoothed down. It is in the highest degree necessary that the process of coating should be conducted as quickly as possible, as we shall presently show.

The easiest of all papers to coat is perhaps that known as *Michallet*, because of its parallel lines. This and the Lalanne and Ingres papers give excellent results, and, moreover, have a quality of their own which is especially suitable to the soft, diffused image which is so much appreciated. It is for this reason that we particularly recommend to beginners the papers just mentioned, both on account of the greater ease with which they may be coated, and because our object is to produce the effect of a painting on soft Sèvres porcelain, where the image is to some extent incorporated with the *pâte*, rather than that of an enamelled surface upon which the picture is kept without any sinking in at all. It must not, however, be allowed to incorporate itself into the actual unprotected fibres of the paper; in that case, as we have already said, it is impossible to remove it.

Either the white or yellow tinted Michallet papers may be used, and probably other and deeper tints will be found of value. Then there are Allongé and other similar French papers, both the right and the wrong sides of which are very suitable. Any old-fashioned hand-made papers may be recommended, and treasures of this kind will often present themselves in old scrap albums or manuscript books. Amongst French papers those known as Canson and Montgolfier are very good and serviceable. Whatman water-

colour paper does not seem to be regularly sized; the colour sinks now and then in spots and makes indelible stains. Ordinary writing paper, such as India, Mill or Imperial Treasury or Bank Post are very suitable for small subjects, the watermark, however apparent during development, disappearing totally when the sheet is dry. Excellent papers of various qualities of grain and thickness are made at the Joynson paper mills, St. Mary Cray. Of their make we can especially recommend, for a fairly rough surface of even grain, a vegetable sized paper known as P. H. Thin M. F.; for rougher surfaces the superfine drawing papers Nos. 6 and 7; and, for a very smooth paper, the superfine No. 23.

Some papers may require sizing, though, as a rule, one may be reasonably content with those which, like Michallet, already possess the desired surface. Should it be necessary to do so, it is easy to size with either gelatine or arrowroot. With the latter a good proportion to use would be about 125 gr. to the pint of water. Take then this quantity of the best Bermuda arrowroot, and mix it into a smooth paste with a little hot water. Then add, stirring the while, the remainder, and bring the whole nearly, but not quite, to the boil. The solution will become clear and of a gelatinous-like consistency. After allowing any foreign matters to settle, the paper may be floated or the sizing applied with a Buckle or Blanchard brush.

THE PIGMENTS OR COLOURS.—In treating of the colouring matters which may be used in the preparation of the sensitised coating, we by no means propose to cover the subject in an exhaustive manner. The endless variations into which we might be led in so doing may safely be left

to the individual feeling and taste of the worker when he shall be sufficiently practised in the simpler forms. For our present purpose it will be sufficient to mention a few only, and with these all the combinations of tone (using the term in its proper colour sense), which are recognised by monochrome artists, may be made. The ideal pigment would be the finest of all powders, giving, with the smallest bulk, the strongest colour. Colours may be used either dry or moist, and probably none better could be found than the well-known moist colour tubes of good manufacture. Amongst these the pigments most nearly approaching the desiderata just mentioned are, in the first place, venetian red, red chalk, indigo, and brown and red ochre. Then come prepared lampblack, umber and burnt umber, sienna and burnt sienna, Van Dyck brown, bistre, and, lastly, sepia. The last named do not give very fine division, and being transparent colours require a certain thickness of layer to give proper depth of colouring. This, of course, involves difficulties in ordinary practice. Indian ink is a good black, but requires very careful grinding and mixing. Common red ochre in the powdered state is also good, and if its crudeness is not objectionable (and it is not so to some) it may be used alone and is easy to work. On the other hand, it may be tempered with a trace of blue. On the whole, lampblack, the ochres and umbers and indigo will form, separately or combined, a palette with which, as a rule, we may be very well satisfied.

Of course all pigments are suitable, provided they are inert from a chemical point of view. It is unnecessary to do more than mention that certain colour preparations are, from some cause or another, which we do not profess to be

able to explain, absolutely unworkable. Either they cause the coating mixture to become totally insoluble, or, on the other hand, the solubility is not affected on exposure; but those just mentioned are all of them permanent pigments, influenced, except for the desired purpose, neither by the presence of the bichromate, nor by the continuous action of light. The use of a white pigment may suggest itself with toned or dark papers. So far as our experience goes, most whites are unworkable, and it is dangerous to mix even a small proportion with another colour. The only one we are at present able to advise is sulphate of barium, known as permanent or constant white. It is scarcely necessary to add that in printing in white on a dark ground a positive instead of a negative would be used.

THE GUM OR COLLOID.—In treating this part of our subject we shall confine ourselves to the ordinary gum acacia or gum arabic of commerce. Undoubtedly other colloids may be used. There are, for instance, gelatine, fish glue, starch, albumen, ordinary glue, and so on, but we find in gum arabic qualities of mellowness and softness, on account probably of its superior solubility, which allows the insolated coating of colour to melt and run down, as it were, and form a kind of pâte. Gelatine or other colloids do not so readily give this effect. Practically, those who think they might find preferable qualities in the latter will easily devise similar methods of using them, and we may therefore leave them for the present out of consideration.

The readiest way of preparing the gum solution is to take the gum in a pulverised condition, as it requires much less time to dissolve than from the lump. It is not, however, a good thing to buy it ready pulverised, dust, dextrine or

other matters being often added to the powdered gum of commerce to give it weight or bulk. It is advisable also to confine ourselves to the best quality of gum acacia or Soudan gum. We require so little that it is hardly worth while to trouble ourselves about other kinds, the soluble qualities of which, it may be said also, vary considerably. It is easy enough to reduce the gum to coarse powder in a mortar, and then to sift it through ordinary wide-meshed muslin. Heat modifies the nature of gum ; it is preferable therefore to use cold water, with which it may be worked up to regular thickness in a quarter of an hour. It will require frequent stirring, the powdered gum being apt to coagulate and to form a viscous lump, which, offering less surface, retards solution. Another way is to suspend in the water the coarsely broken up lumps enclosed in a muslin bag.

Freshly-made gum solution gives the maximum of solubility. It would therefore be an advantage to use old solution if it were possible to ascertain to what degree of acidity this had arrived. But the transformation seems to be irregular, influenced, as it is, by contact with atmospheric germs, and by weather and temperature. A solution of gum rapidly becomes sour, and it is important for us to know the degree of solubility which it possesses. Although, therefore, the addition of a preservative (such as a few drops of chloroform water) may arrest the tendency to acidity, the safest plan is to use fresh-made solution for every batch of papers to be coated, and thus be in possession of a standard quality which will save us much trouble in exposure or development. After a few trials it is easy to judge how much gum is required for the number and size of sheets to be prepared. Beginners are apt to make up about

five times the necessary quantity of sensitising mixture. Two thimbles full of gum added to the bichromate and pigment will easily cover a whole sheet of drawing paper. The gum should be filtered before use through a piece of muslin. With a funnel the filtering surface is too small. The easiest way is to pour the solution on to a square piece of muslin and hold this by the four corners over the saucer used for mixing; the gum will drop slowly by its own weight

THICKNESS OF GUM SOLUTION.—The percentage of gum is a very important factor. Most failures in coating are due to an exaggerated thickness. This error is particularly noticeable in the coating of large-sized sheets of paper, because they take longer to cover. If the gum is too thick, the preliminary smearing process takes so long that when the softener is applied the mixture has had time to set, does not divide under the brush, and makes thick ridges which render the paper quite useless for printing.

Gum solution ought to be sufficiently thin to fall slowly in big drops through the moderately thin muslin used for filtering (ordinary cheap muslin, not poultice muslin) without any pressure of the fingers. Gum that has to be forced through by twisting or pressure is too thick and will give trouble. Generally speaking, the best proportion to use is a solution of about thirty to thirty-five per cent. strength.

PREPARATION OF THE SENSITIVE MIXTURE.—The mixture of pigment and gum should be as intimate as possible. If several colours are used it is best to mix them thoroughly first with a hard oil brush, then add the gum, mix thoroughly anew, and finally add the saturated solution of bichromate of potash and mix for the third time.

The bichromate solution is made by dissolving ten parts of the salt in a hundred parts of water. The water may be used warm, leaving a small quantity of the bichromate undissolved.

It would be possible to give a formula for the quantity of bichromate to be added to the mixture of pigment and gum, if the proportions, of pigment were in every case constant. But they are not, for great depth of colour can be got with a small proportion, say, of red chalk or lampblack, whilst a far greater bulk of colour is needed with the sepias, Van Dyck brown, bistre, or umber. On the other hand, there is a standard degree of thickness necessary for rapid and even coating. It follows, therefore, that more bichromate has to be added to a sepia mixture to dilute it to proper fluidity than would be required for lampblack, because the smaller bulk used of the latter gives a much thinner consistency. Only repeated trials can teach the beginner what degree of thickness will allow of even coating. As a guide, let him begin with common red ochre, and taking equal parts of gum and bichromate, say, one drachm of each, use with this forty grains of the pigment. A trial coating may then be made on a sheet of paper, and according to the conduct of the mixture under the strokes of the brush we can judge whether the proportions are correct or whether either gum or bichromate should be added to thicken or dilute the consistency. The sensitive compound does not keep, but the gum mixed with colour will do so under the same conditions as plain gum.

COATING THE PAPER.—For coating we shall require two different brushes; one fan-shaped, of hog's hair, about four inches wide, with rigid hairs thinly set for roughly smearing

the mixture on the paper, the other of badger hair, from four to six inches wide, of the kind known as a stainer's sweetener or softener. The latter brush is a most important tool. It is a comparatively simple matter to put an even wash of water-colour on paper, but when we have to deal with a clogging gum solution, to which is added the peculiar stickiness given by the bichromate, we should be entirely lost were it not for the badger sweetener. This brush is



SMEARING BRUSH.



BADGER-HAIR SOFTENER.

somewhat expensive. A four-inch brush of three rows of bristles cannot be had for less than six shillings; one of six inches, with four rows, would cost a guinea, but so useful and necessary is it that it is worth while to procure one of the best quality. The fan-shaped hog's-hair brush is recommended for the preliminary smearing on account of its wide-spreading area and the thin setting of the hairs. Ordinary brushes take up too much colour. A few trials will show that if too much coating has been dabbed on the paper

it is difficult to get rid of the excess, but the fan-shaped brush has to be dipped in the colour several times, and this assures, or at least facilitates, the minimum of mixture being used. With regard to the softener, goat-hair brushes, such as are sometimes sold for dusting dry plates before putting in slides, may also be used, and they are cheaper than the badger. Some workers even use a hog's-hair brush as a softener. In any case it will be, perhaps, a matter of personal preference, and the handling will depend upon the character of the brush used.

We have now our sensitive mixture ready prepared in a shallow, wide dish, such as a small porcelain developing tray, our smearing brush moistened in water, and our softener clean and dry, and are ready to proceed with the coating of the paper.

CHAPTER IV.

COATING, EXPOSURE, AND DEVELOPMENT.

COATING THE PAPER.—The operation of coating is one which requires a little dexterity, but attention to correct proportions of the sensitised mixture, and the proper use of the invaluable tool which we possess in the badger hair softener renders it not difficult of acquirement. We may remember that the points to be aimed at are an even distribution of the coating over the surface of the sheet with the least possible quantity of the ingredients employed. We do not desire a film of such extreme tenuity and evenness as that which characterises the Artigue Papier Velours, nor, if we wished it, should we probably be able to secure these conditions without special machinery. For a paper in black pigment and for certain effects we could ask for nothing better than that of Artigue, but our aims are different.

We have, then, our paper, brushes, and coating mixture ready to hand. Take a sheet of the paper, cut about an inch larger all round than the size of the negative it is proposed to use. Pin it with two drawing pins on a flat wooden board by the two upper corners, so as to allow of even play to the stretching which results from the application of moisture. Then with the fan-shaped brush smear the sensitive mixture over the paper, taking the greatest care to use the minimum quantity necessary to cover the sheet.

Do this as rapidly as possible, and the moment the paper is rubbed all over—roughly smeared—take the softening, or sweetening, brush, which is quite dry and clean, and give three or four vertical parallel downstrokes from top to bottom, with strong, equal pressure. Then as many more from left to right with less and less pressure, and, finally, gently dust or flick with the brush in all directions, holding it vertically or perpendicular to the surface until all streaks or unevenness have disappeared. At this stage the film has set, and should not again be touched; any additional brushing will do more harm than good. The coating should be so thin that the grain of the paper may easily be distinguished through it.

To ensure good coating the whole operation—smearing and softening—ought to be performed (for a whole-plate sheet) in about forty to fifty seconds. Rapidity in coating is most important, because of the peculiar nature of the sensitive mixture, for bichromated gum does not behave like pure gum solution. After a certain time it assumes a sort of gelatinous consistency quite different from the ordinary thickening of pure gum. If kept in a bottle it will form a quivering mass like calf's-foot jelly, moulded into the form of the bottle. This phenomenon takes place more rapidly with the thin film spread upon the paper, and when once it has taken place if the film is disturbed by additional brushing, it is impossible to smooth it down again. That is why we insist upon the necessity of smearing and softening as rapidly as possible.

Now, in order to coat the paper rapidly under the most favourable conditions the mixture must be of a certain consistency, spread thin. Practice will prove this, and after a

few trials indicate the proper proportions. It must be distinctly *gummy*, and the right thickness will easily be recognised by the peculiar clinging sensation under the strokes of the brush during the operation.

Coating may, and ought, to be done in a good light, but the paper must be dried in the dark, because, although insensitive whilst in a moist condition, it becomes sensitive immediately on dessication. Absolute darkness such as is necessary for gelatino-bromide film making is not necessary, but any direct white light should be avoided. The paper may be hung up to dry by a clip in one corner, and in half an hour or so—in ten minutes in a dry room in summer—dessication is complete. On no account must the paper be dried before a fire or stove, near enough to be heated. Insolubilisation would follow.

It is advisable to use the paper as soon as possible after preparation—say the next morning—because we then may feel assured of a certain typical condition of solubility in the gum, and we shall avoid errors in exposure. If kept, it should be stored as much as possible under pressure to avoid contact with moist air. It keeps well for two days, fairly well for five, and we have ourselves developed paper eight days old which gave excellent results for landscape work. For figures it was rather patchy in the lights.

It might be possible to prepare the paper with the mixture of colloid and colour only, and to sensitise it by immersion in bichromate solution only when required for use. This method would certainly have great advantages, but so far as our experience goes at present it is not practicable, paper sensitised in this way, if gum be the colloid used, remaining soluble even after long exposure. Such a result would, of

course, be expected when we remember that our coating is easily soluble in cold water. What image can be got after sensitising by immersion will necessarily, therefore, be weak.

THE EXPOSURE.—Correct exposure is, of course, a matter of experience, and to some extent also of personal taste. We mean that what might be over-exposure for a particular effect would be under-exposure for an opposite one. In reality an over-exposed print is one that cannot be washed up to the desired effect ; an under-exposed print is one which will not retain a sufficient quantity of the pigmented gum.

Generally speaking, our aim in exposure should be to work up to certain conditions, which, as we shall show when treating of development, it is as well to keep constant : these are the condition of the gum as to solubility, and the temperature of the water used in development. We may, then, make use of a normal or of a greater or less degree of insolation according to the effect we have in our mind, and to the method in which we may use our developing appliances.

It is best for a beginner to err on the side of over-exposure, for the use of very hot water, soaking for a few hours, or developing by friction with a brush or sawdust, gives a certain latitude on this side, whilst real under-exposure means washing away of the half-tone to begin with, and the subsequent obliteration of the whole of the image.

Gum bichromate paper is decidedly slower than chloride paper, or, to compare similar things, than Artigue paper or the ordinary carbon tissue. On a bright winter's day at noon in the shade, a thin negative will require about an hour's exposure ; an average negative will take two hours at least.

Correct exposure can only be arrived at by repeated trials,

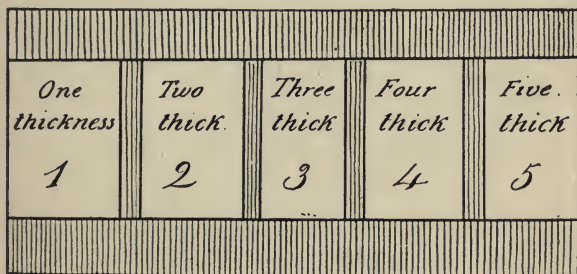
and even when it has been obtained and the actinometer number registered, it does not follow that the same negative with the same exposure will give similar results, if, for instance, another batch of paper has been used ; for length of exposure is proportionate to thickness of film, which often varies without the operator's knowledge according to the colour used, or to more or less heaviness in the touch of the coating brushes. A thick film demands, of course, a much longer exposure than a thin one, for insolubilisation of the shadows must work right up to the paper. If it does not do so the substratum remains in a more or less soluble state, and will dissolve during development, carrying the upper insoluble particles with it. Such cases will, however, occur only when we are working for certain unusual effects, and with the latitude to which we have already alluded, and the skilful use of our materials, we need not trouble much under ordinary circumstances.

The easiest negatives to work are, in our own opinion, very thin ones—*i.e.*, the fully-exposed negative rather under-developed. Others prefer a dense quality ; what are called plucky negatives, with strong contrasts. But we must consider that richness of tone is not produced in the same way as, for instance, in silver printing. We put the depth of colour on the paper beforehand ; all that we have to do in developing is to keep there the amount of weight of it which we desire, so that the thinnest negatives can give great depth and richness as well as denser ones. It is a question of more or less exposure. The whites are the first to go, so, of course, hard contrast makes development difficult even with a strong proportion of bichromate, because what is sufficient development for the high lights leaves the shadows clogged

and heavy, requiring vigorous brush development. Theoretically, different percentages of bichromate should perhaps be used according to the negative, but practically this would involve a nicety of detail which few will think justified by differences in result.

THE ACTINOMETER.—An actinometer is essential in our practice, as it is in other carbon printing methods. There are many well-known types, the best of them, perhaps, that known as Burton's. This has a number of little figure negatives of varying degrees of intensity, and is better than those with letters or numbers only. As, however, we wish our instructions to be as complete as possible in themselves, we will describe another form which is very practicable, and more akin to the materials of which our prints are made.

Cut, say a half-plate piece of glass in half lengthwise, and upon one-half gum strips of translucent paper, one on the



THE ACTINOMETER.

top of the other, so that the first shall be about half an inch longer than the second, the second than the third, and so on. Six or eight of these may be so arranged, thus producing a strip with as many different densities. Border the whole

with an edging of black (needle paper), and divide the different densities by strips of the same. Place the other half of the glass over the first one, and adapt a linen hinge on one of the longer sides. When ready for exposure a strip of paper coated with gum bichromate solution without any, or with very little, colour, is placed between, and the actinometer is used in the usual way.

In order to have some idea of the symptoms of gross under or over exposure, it is a good plan to expose an average negative for, say, twenty minutes in the shade in winter—ten minutes on a bright summer day. Then cover half the negative with cardboard, and continue the exposure for three hours in winter—half the time in summer—and develop with warm water.

DEVELOPMENT, OR WASHING UP. — Development is an accepted term in photography for all processes of bringing up the latent image, but in carbon printing (to use the generic name) the French have a more expressive word. This is “*dépouillement*.” It is not easy to find a corresponding term in English. It means the despoiling, stripping, unclothing, revealing, discovering, getting rid of the superfluous—may we not say, considering the method used—the washing up? For development implies rather the heightening in character of that which already exists faintly than the removal of a veil which covers it.

PRELIMINARY EXPERIMENTS. — In order to learn by experience in what condition our paper should be before we proceed to washing up, it is well to discover what kinds of failures are caused by wrong proportions in the coating mixtures or by defects in the process of coating. By so doing we shall be able, later on, to localise the causes, and

not to ascribe, for example, the result of a defect in coating to a lack or excess of exposure.

Take a coated sheet of paper which has not been exposed to light, and develop it, using cold water or water at about 50 deg. F. If the bichromated pigment has been properly mixed and properly spread, it will dissolve gradually and equally, showing a flow of minute particles of colour, coming, at first, from the surface only, so that the lightening of the general aspect ought to be very gradual, passing from black to dark grey, then to grey, light grey, and white. Layer after layer of colour has been successively dissolved, up to the paper support.

If, on washing up, the paper shows a colour stain all over which cannot be removed by hot water but demands friction with brush or sponge, the proportion of gum in the mixture has been too small, the paper has absorbed the pure colour and is useless for ordinary work, though it may be of service for certain effects where no high lights are wanted. It is to be remembered that paper is always more or less stained by pure water colour, and that it is the presence of gelatinous gum which prevents the colour from sinking and allows the total removal of the pigmented surface, leaving white, unstained paper beneath. This stain will therefore appear when colour is in excess in relation to proportion of gum, or when the proportion of colour is adequate to the desired depth of tone, but the quantity of bichromate is too great and has diluted the gum to an undesirable consistency.

Take, again, a sheet of paper and coat it with a mixture of bichromate and pigment without adding any gum. Expose and develop. Scarcely any colour will wash away, but on rubbing the paper with a pad of cotton wool the

picture will appear, the whites being totally and indelibly stained with the pigment.

If, on developing an unexposed sheet of coated paper, the film, instead of dissolving equally, breaks up into a quantity of minute scales, it is a sign of extra thick coating. This is easy to prove also, for on developing an exposed print one often notices this scaly breaking up on the outside edges of the paper where the excess of mixture, brought by every stroke of the brush, has accumulated during the coating process, the print itself developing gradually and correctly in the centre part where the film has been thinned down by greater pressure of the brush.

If the unexposed film refuses to wash away, or washes partially away, leaving patches and black stains of pigmented gum, the paper is of no use whatever. Old gum which has become acid by fermentation has been used, or the paper—good when fresh—has been kept too long, or it has been dried close to the fire and heated too much, or has been exposed to direct, hot sun rays; in fact, insolubilisation, not due to light, has occurred.

The above experiments will prove extremely useful in practice, for if a piece of paper coated with the same film which has thus been tested and found satisfactory gives a bad result on washing up after exposure, there will be every reason to ascribe the failure to incorrect exposure and not to false proportions of mixture or imperfect coating.

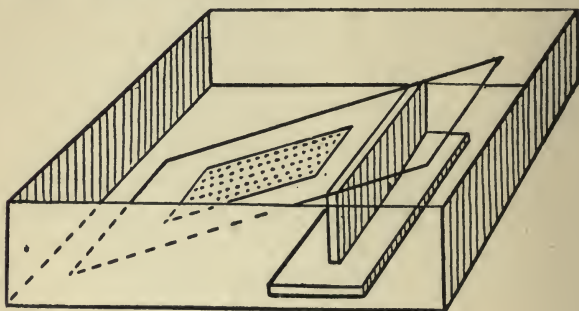
WASHING UP.—Some workers develop under water, immersing the print face upwards, and gently rocking the tray until the soluble parts of the film are dissolved. Others immerse the print and let it float face downwards, leaving it to soak and develop of itself. This is pure mechanical

development, and though we may make a beginning in this manner, if we were satisfied with it entirely we should be taking no advantage of the great selective facilities we have at our disposal and should be reducing our work to the level of other mechanical processes.

In any kind of chemical development the reducing agent, brought into contact with an exposed sensitive film will exercise its action equally over the whole of it because it is a chemical action. All that can be done to control its power is to apply more of it in some places than in others. In gum-bichromate development there is no chemical reaction. The film is first of all softened, then partially dissolved and washed away by water ; so if a stream of water is allowed to run over half the print while the other half is simply moistened, the first part only will be affected. In chemical development the agent used has a power of its own independent of its quantity. In fact, the developing power of the water is proportionate to the frequency of its application, to the quantity of its flow, and to the force of its stream.

The method of development which we recommend is that in which a stream of water is used flowing over the print from a sponge, and is practised in the following manner: The prepared paper is taken from the printing frame after having been placed there film to film with the negative, a depth of about an inch turned down on one edge to prevent the action of light on that portion. It will be found useful to do this, because some judgment of the quality of the paper may be formed from the behaviour, during washing up, of this protected strip. On removal from the frame the print is first

immersed in cold water, or in water at no higher temperature than 65 deg. F., and is then placed on a glass plate about a third larger than itself. This plate is placed in an inclined position in a large developing tray half filled with cold water, one end immersed in the water and resting on the bottom of the tray, the other tilted up and supported by a little wooden stand about three inches high, or in some other convenient manner which shall permit the angle of inclination of the plate to be altered, and so cause a flow of water over it to be more or less rapid. Two sponges are



DEVELOPING TRAY AND SUPPORT.

used, one small enough to be held in the palm of the hand, the other somewhat larger; and a can of hot water. The large sponge is filled with cold water and gently pressed at a few inches distant from the glass plate, upon which it falls and flows over the print, which is held in position with one finger. It is important that the stream of water should not fall on the print itself until we know that the film is sufficiently insoluble to stand the shock. After a few minutes of repeated floodings with cold water, the image, if capable of being brought up at a low temperature, ought to have appeared.

If not, the sponge is dipped into the hotter water (which should not exceed 100 deg. F.), and the print flooded several times. Very careful watching is necessary at this stage of the proceedings, for often a simple application of the warm water is sufficient to loosen the film and to start development; and if too hot, mischief is at once done which it is impossible to repair. If, however, the print resists the first warm floodings, hotter may be cautiously used until the outlines of the picture are visible. It is then that selective development begins.

The worker will have done well to provide himself with a silver print from the negative (it will help him if this print stands before him during development). He knows already what are the errors to be remedied, what values require to be strengthened, or to be brought down to their true importance. He has noticed where the deepest shadows are (and here water may be freely applied), and where the most delicate half tones lie and are to be treated with the utmost precaution. Little by little he will determine the general scale to which he will have to work up, and the key in which his picture is to be set. He has found, perhaps, how effectively a high light may be placed here, a shadow left there in all its depth, or opened up to the light, or where some white patch disturbs the equilibrium of the picture, and must be lowered or counteracted. Local development will enable him to approach as near as possible to the ideal composition which he has built up in his imagination on the imperfect document furnished by his silver print.

Local development may be carried out in numerous ways. We may, for instance, take the smallest sponge and press it gently as close as possible to the particular part of the print

which may require clearing, taking care by shifting the position on the glass plate that the water does not run off too forcibly over some other delicate portion. Now and then a more copious flooding of cold water will tone down the edges of the locally developed portions ; the general progress is watched from time to time from a little distance, and development renewed until the desired effect is brought out. Very hot water from the can will be used for the darkest shadows ; lukewarm, obtained by dipping the sponge into cold and hot water alternately, for the intermediate values ; cold water for the delicate half tones. Or the work may be carried on by means of a minute flow of water directed through a glass pipette or nozzle with a tube communicating with a small reservoir placed high enough to give a certain force ; or through an ebonite tube with flexible ball held in the hand such as is used for blowing magnesium through a flame for flash-light ; or by squeezing the sponge as it lies in the open part of a funnel ; and in numberless other ways whereby control upon exact spots may be maintained. Throughout the whole there need be no hurry ; the work may be left and resumed as one pleases, and one has time to think, and look with another eye upon the growing picture. *La nuit, even, portera conseil*, if our impatience and greed of work will permit us to avail ourselves of it.

Development with the brush is carried on on similar principles, but it can only be used if the exposure has been long enough to ensure a sufficient firmness of film. Every worker will find out the different conditions for himself ; how far, for instance, it is safe to allow the loosening action of the first warm water to go, and the

temperature at which this may be applied. It will vary according to circumstances, and our experience of the behaviour of the film under our first cautious beginnings will show us in what directions our next steps may be taken. There is, of course, infinite variety in the brushes or other implements which we may now bring into play, and the way in which we may use them. In some cases we may, while so doing, keep the print under the surface of the water, which thus forms a kind of elastic cushion between the head of the brush and the film, and allows of comparatively greater force being used. At times we shall employ gentle smoothing strokes beneath the water of wide and soft camel's-hair brushes; at others we may use the tapping action of the sparsely set stiff hairs of a badger hair pencil held vertically, or even a stiffer hog's-hair brush.

At other times the print may be placed face up on a glass and worked upon the bare surface, but this requires extreme caution; the slightest and minutest touch may ruin the picture, while on the other hand a brilliant inspiration will, with the production of a single point of light, skilfully placed, achieve in a moment the wished for effect.

We have not yet learnt how to discover half the possibilities, but what our experience has been able to show plainly is that the varying conditions of prolonged exposure, the manner in which the film is first loosened, and the subsequent treatment of it by various brush methods combine to place in our hands a variety of effect, the gaining of which it is well worth while to master.

Great care and delicacy are necessary in this mode of development. Hand and brain must work together, and every stroke of the brush must be actuated by deliberate

intention, and made in the right place with a firm yet delicate touch. Hurry is fatal. When once the pigmented surface has been disintegrated by friction, water development should not again be taken up. It would tend to wash away the layer where it has been touched, and therefore if during water development brush friction is necessary to clear heavy shadows this should be done when the print is complete in other parts.

There remains yet another useful method for commencing development and clearing the print for the more delicate after-treatment. This is the use of the sawdust soup of the Artigue process which we shall describe presently in its place. The action is, however, tolerably strong even with a very thin mixture and can only be used after prolonged exposure.

RETOUCHING.—Retouching is a delicate operation with which it would be impossible to deal here other than in a summary manner, and may be left to the individual skill of the artist. It must, of course, be carried out so as to harmonise with the general character of the work, and be in no way conspicuous. We should in a general way use the colour employed for the groundwork of the print, but we must remember that this has been mixed with bichromate and afterwards acted upon by light. A good plan is to take the bichromated mixture and applying it where required (this may be done roughly), immediately or shortly afterwards pour water along the top of the print, allowing it to flow downwards and carry off what is superfluous. In this way, were it desirable to do so, it is possible even to make additions to the work. The limitations to such additions, and their legitimacy, must be left to the honesty of the artist.

CLEARING.—When the print is thoroughly dry it is necessary, for its future permanence, to rid it of the chromic salts imprisoned in the layer of gum and pigment. This can be done by soaking in an alum solution, but it takes some time and the print also loses something of its soft, delicate effect. A better and quicker way is to immerse the dry print for one or two minutes in water to which has been added sufficient bisulphite of soda to produce a distinctly sulphurous smell. The yellow stain left on the paper by the bichromate disappears immediately, and a minute or two of subsequent washing is all that is required, for bisulphite of soda is extremely soluble.

ACTION OF HEAT AND ACID ON THE SENSITIVE MIXTURE.—A strong proportion of citric acid or a smaller proportion of more active acid added to the mixture of gum and bichromate will utterly destroy its sensitive properties; that is, will render it insoluble without exposure to light to such an extent that repeated friction with a sponge and hot water will scarcely affect it. We may, therefore, take advantage of this property to counteract the excessive solubility of freshly prepared paper and lessen exposure, giving more stability to the half-tones. A small quantity of a weak (say 5 per cent.) solution of citric acid, or simply a few drops of lemon juice added to the sensitive mixture, will start insolubilisation and allow of slower and surer development. It is better, however, to master the ordinary process before resorting to this expedient.

Heat also produces insolubility, and care must be taken not to dry the paper too near the fire, or to expose in the direct rays of the summer sun.

It will be gathered from the instructions which we have

now given that in order successfully to prepare and develop hand-coated paper, it is necessary to pay great attention first to correct proportions of the sensitive mixture, next to an even, thin, and rapidly applied coating, and lastly to the degree of exposure to light.

The power of insolubilisation, or, as it may otherwise be called, of sensitiveness, of the paper ought, one would imagine, to be in direct proportion to the strength of the chromate solution. We know that chromic acid hardens colloid matters: quickly in the presence of light, slowly in darkness. It would follow that insolubilisation should take place more or less rapidly according to the greater or less concentrated strength of the agent. If, therefore, the proportion of bichromate is reduced to a minimum, longer exposure will be necessary, and *vice versa*.

Upon this point, however, differences of opinion have been expressed. In an article on the subject in a Viennese photographic journal, Mr. Watsek (whose admirable pictures by this method were so prominent at the London Salon of 1896) appears to hold that the proportion of bichromate has but a very feeble influence upon the character of the image, and that exposure is proportionately longer according to the greater or less quantity of gum in the coating mixture. But it is worth while noticing that, of necessity, the more gum there may be in a given quantity of the sensitive solution the less will be the strength of the bichromate, reduced in volume and weakened by the water in the gum.

Amongst the factors governing our work probably that which determines the duration of exposure is the most important of all, and as this is affected by the composition of the sensitive coating, and by its thickness, it presents, of

course, some difficulties which will vary according to circumstances.

There are, therefore, many questions upon which the worker who wishes to make himself acquainted with all the capabilities of his medium will do well to satisfy himself. Amongst them the effect upon the image of different relative proportions of gum, colour, and chromic salt, and the thickness or otherwise of the coating, are worth his careful study. For all these matters it is impossible to formulate direct instruction. In the preparation of the coating mixture and its application to the paper, a certain amount of practice will teach a good deal. For instance, the right consistency for coating will be instinctively recognised without the necessity of weighing and measuring. One finishes by *feeling* what is the right proportion. It cannot be explained. It is like the knack of an engraver wiping the plate with the palm of his hand—he *feels* that it is right—while another man doing the same thing would do it wrong.

In the details of the practice of photo-aquatinting which we have given we have endeavoured to be as precise as possible, so that this method of printing in pigment should be available even to those who know nothing whatever about other processes in photography. For those who do, and are able to perform for themselves the very simple operation of developing a negative, we have, we hope, assisted to still further simplify the details of photographic procedure.

A few words may now be said upon the method of working a kindred process, viz., the very beautiful paper known as Artigue Papier Velours, and in adding some considerations and reflections upon the subject in general our task will be done.

CHAPTER V.

ARTIGUE PAPER.

FOR some who may desire different qualities from those for which the hand-coated paper we have described is suitable, and who wish to use a direct carbon paper, without transfer, capable of giving as faithful a counterproof from a negative as can be obtained by any other photographic process, certainly none could be recommended more than the "Papier Velours," generally known as Artigue paper.

We have already alluded to the incredulity of those who maintained, in the face of evidence to the contrary, that carbon development must of necessity take place from the back of the coating. The prints by Artigue's process shown in 1894 at the Photographic Salon, and the admirable examples exhibited at that Exhibition, in 1895 and 1896, by Monsieur Puyo, are sufficient proof, in themselves, of a long-established error.

We know no method of coating paper with bichromated gelatine and pigment which is capable of giving the texture which we find on this paper, except perhaps the use of such an instrument as the air-brush. We have used this machine, and certainly with it an extremely fine and even coating can be applied. What the pigment may be, which Monsieur Artigue employs, what the colloids, what the substratum, and how the coating is effected, are still the maker's own secrets.

The paper has a surface of extraordinary fineness and homogeneity—a pigment of some peculiar black mixed with a little gum and possibly some gelatine and fish-glue also. Viewed by reflected light, it is a dead velvety black, and so soft that a moist finger easily removes it. By transmitted light the paper is almost transparent, with a quite light greenish-grey appearance, very regular indeed, with no apparent surface faults. The secret of its quality, in fact, the whole secret of preparing paper for development from the front so that it shall give the most delicate gradations of half-tone, is in the extreme tenuity of coating and the perfection of evenness in which the pigment is held in suspension, allowing of absolute regularity in distribution. At present it is only made in black, and there appears to be some difficulty in using other colours; at any rate, those which have, till now, been put on the market, have not proved to be satisfactory.

In 1878 Monsieur Frédéric Artigue produced a paper covered with a thin layer of some colloid substance with which was incorporated a very fine black powder. This was intended for the reproduction of architectural plans and other line work, and was developed by friction with a soft wet sponge. On one of the plans sent (in negative form) to Artigue for reproduction there happened to be in one corner a small water-colour sketch. On development he found, to his surprise, reproduced, in all its half-tones, the original drawing. This put him on the track. He made experiments, but unfortunately died before he had perfected the system. His son, Victor Artigue, took the matter up, and in 1889 showed, for the first time, perfect prints at the International Exhibition of that year. He then demon-

strated his method of development before the Société Française de Photographie, but as he would neither supply his paper nor communicate the method of preparation, that Society was incredulous and awarded him a medal for *results* only. The paper as now supplied was first placed upon the market in 1893. It will be admitted that we have in it a carbon paper of a very high degree of excellence. The blacks are intense, and, if desired, the whites may be retained with great purity and brilliancy. The surface is delightfully soft in texture and the scale and gradation of tone unusually extended.

The paper is supplied unsensitised and in that state will, of course, keep indefinitely. It appears however to vary in quality. The emulsions used do not seem to have always a constant power of resistance to the temperature of the water used in developing. They may, in fact, be divided into two categories: that (and this is unusual) in which development may be effected at a temperature of 60 to 65 F., and that which requires to be attacked at a temperature of F. 80 or higher.

The earlier method of sensitising was a tedious and uncertain one through the back of the paper, but as was shown at the Photographic Salon Conference in 1894, a simpler way that by immersion, is quite as efficacious. At first, also, development was effected with baths of comparatively high temperature. Now, it is practically cold throughout, at least at a temperature no higher than that of water in summer.

To sensitise, prepare a two per cent. solution of bichromate of potash in a flat dish. In summer the strength of this solution should be reduced to one and a half per cent. Immerse the paper in this gently to avoid air-bubbles, and hang

up by one corner to dry in the dark. As the pigmented surface is very tender and easily rubbed off, it is convenient to put a little metal clip at each corner of the paper, to lay it on the bed of the dish, flow the solution over and handle by the clips only.

Exposure is made with an actinometer in the usual way, and the paper when freshly sensitised may be said to be about three times as rapid as silver paper, say about the same as



DEVELOPING.

platinotype. For development, very finely pulverised sawdust (a special preparation, to be obtained with the paper) is generally used.

Of course this is of no necessity. A brush, rocking, laving, flowing from a sponge, plain water, and other ways would

develop in time ; but the sawdust, by its soft rubbing action and adaptability to different conditions of exposure, is very useful.

Make, therefore, in a large, very deep earthenware pan, a thick soup of this sawdust and cold water, and have ready a coffee pot or similar utensil with a very wide (about an inch wide) spout. After exposure take the paper and place it in water at as near as possible 65 deg. (not more). In a minute or so a faint image will be seen. Lay the paper on a sheet of glass, and placing this on an easel over the pan, or holding it in the hand, pour the sawdust mixture along the top of the print, letting it run back into the earthenware pan. At first the sawdust mixture should be taken from the top ; afterwards, by dipping down and stirring up, it may be taken thicker. The character of the negative and the degree of exposure will determine the thickness of the developing mixture and the manner of applying it. Every now and again a dash of cold water will reveal the picture and satisfy us as to the progress of the development, and finally, the usual alum bath to discharge the bichromate and harden the pigment, will complete the print. Development must continue until the print is considerably lighter than it is desired to be when completed, as it darkens very much on drying.

Throughout, the operations have been with cold water only. There has been no anxious inspection of thermometers, no squeegeeing, no transfer from one support to another, no pressure between blotting boards ; we can suspend and take up development where we will ; there is no film to blister and leave the paper, no safe edge to make to the negative and, finally, there is no reversal, end for end, of the picture, but a true positive from a negative.

The whole process of development, in the case of a correctly exposed print ought to be complete in a minute or less. If it takes longer the exposure has been wrongly timed. In cases where we deliberately seek for particular effects, very prolonged exposure and subsequent special treatment give a power of altering the general character of the print and of modifying the rich velvety black to a more delicate engraving or pencil-like effect. But we prefer at present to consider the paper in its more automatic character.

CHAPTER VI.

CONCLUDING REMARKS.

IT is not to be imagined that the system of printing which we have described is one which will meet the taste of all who occupy themselves with photography, or that it will be in consonance with the views of those whose preferences are, for the most part, towards mechanical and automatic procedures. Neither can it be pretended to be a simple or an easy process : there is little of the “press the button” character about it.

Whether or no photo aqua-tinting may strictly be termed pure photography may perhaps be matter of opinion. It is at any rate photography, and for those who judge with discrimination will always preserve a distinctly photographic character. It is true that the results differ from the earlier type, and a very few years back might easily have been taken, at first sight, for chalk or water-colour drawings. This, in fact, they are, for there is nothing left on the paper but pure water-colour, with just sufficient gum to hold it in permanence.

At a recent exhibition, referring to one of these pictures, a painter was asked, “Supposing such a photograph had been sent in to an ordinary exhibition of pictures—of course, nowadays with your knowledge of our methods you would recognise it as a photograph—but what would you have

said a few years back if it had been sent without any indication?" He replied, "Well, I should have said, what's the man about ; why is he working in this photographic sort of way?" And so, of course, it is. The photographic way appears to those trained in other systems to be wrong, but we have no desire to hide it, or to admit that it is wrong. On the contrary, we wish to uphold it, and to say emphatically that these results must be in essence photographic ; at least, as much so as in other photographs where licence is permitted.

We must fully recognise the limitations of our medium. There is no necessity to alter its characteristics ; our avowed purpose is to accept them, and our endeavour to express ourselves by frankly making use of the means at our disposal. We may set up our own standard without reference, of necessity, to the conventions and principles established by other methods. The photographic character will always remain, for those who are capable of discovering it. If, in the phase of transition through which we are, perhaps, now passing there may appear to be an ill-defined purpose, it is the natural result of the struggle to be free from the trammels imposed by those who, inspired by feelings of an entirely different character, sought to govern by the same laws two opposite and distinct applications of photography.

It is necessary to say here a few words concerning the legitimacy of the licence in practice to which we just now referred. We are entitled to ask from those who may oppose it that they should be consistent and logical in their condemnation ; that is to say, that they cannot be permitted to approve here and to condemn there according to individual inclination or the reverse. Now practices in photography which

appear to be universally condoned are vignetting, sunning down, adding clouding, matt varnishing and scraping off, shading with the hand, a cloth, or in other ways while printing, with many others. How often do we see a figure posed against a background, on which all sorts of accessories—furniture, steps, balustrades, windows with rays of light streaming in, landscapes even—have been painted, and if nothing more remains, purely photographic, than the principal figure, still no objection is made to the photographic character of the whole. Suppose it were possible to apply selective development to negative making, would it not be practised?

It would, of course, be easy to multiply examples and parallel cases. The whole gist of the question lies in this: Is a photograph to be rigidly produced by mechanism, or are assistance and modification by the skill and craft of the artist to be allowed?

It is not to be contended that we advocate such practices as, for instance, the addition of any absolutely new matter to the print; that we are in favour of such liberty as would allow the painting in, say of a tree or flower where none would be produced through the medium of the negative. But it is impossible to draw any hard and fast line. The conscience of the artist will alone accuse or absolve him. Neither is there any essential difference in this respect between the method of photo-aquatinting and others; such, for example, as platinum printing and the use of glycerine in the modification of tone by keeping back portions of the print. In itself the development *may* be carried out in an absolutely mechanical manner, say by soaking in water until the soluble parts are washed away.

Few, however, will deny that the latitude at our disposal, if intelligently used, is of infinite value. It constitutes the beauty and the essence of the system, and it would be drawing a very fine distinction indeed to say that here there is no art.

An objection to be anticipated is that in using the methods we have described, the result does not truly represent the original negative. But what has the beholder of a picture to do with a negative? The true test is that an intelligent and artistic observer shall see no incongruities forcibly apparent. The public does not want a scientific expert's opinion, for it does not come to a picture gallery to be instructed in chemistry and optics.

We must be prepared to hear these results qualified as imitations, but the charge is scarcely justifiable. The resemblance, which is called imitation, cannot or need not be avoided. We work in photography upon similar principles to those which govern other monochrome systems. There is nothing contrary to the art of painting by light when we produce an enamel which is like a miniature painting, a platinum print which recalls a mezzotint, a photogravure which is truly an etching, or a carbon print which is truly a drawing by light in pure carbon and therefore may be like a charcoal drawing. None of these arts has a monopoly which is disturbed in the same way as when water colour trenches upon the technique of an oil painting.

There is one point of view which is important. It is that we must submit to have our pictures judged upon other grounds than those which govern our appreciation of the mechanically produced photographic print. We have but

lately begun to practise these more personal methods, and faults of arrangement, of harmony, and of light and shade have been tolerated with perhaps too much lenience at our exhibitions. But a greater discrimination will doubtless before long be applied. Efforts admittedly crude, and glaring in falsity, will not deserve acceptance merely on account of difficulties overcome, and of the novelty of the system. Less and less will credit be given for qualities due to the machine, or the model, or to nature's own arrangement.

POSTSCRIPT.

SINCE the above pages have been in type, a modification of some importance in the method of coating the paper has suggested itself.

Certain difficulties will sometimes occur, of which the causes are not always apparent. For instance, using perhaps precisely the same procedure as we may have done before with success, a print will develop itself clear and brilliant, but, shortly before becoming dry, the film will melt and run and presently leave nothing more than a smudgy mass. On the other hand, the paper when freshly coated with the proper proportion of the coloured mixture will sometimes be found to be stained with colour to such a degree, even without any exposure to light, as seriously to interfere with the subsequent development.

Now the principal charm of the method of printing which we have described lies in the peculiarly soft and delicate character of the image produced by a certain amount of melting and running down or mingling together during development, or drying, of the sensitised and exposed pigment. But if this condition takes place in excess of requirements, the result is, as we have said, a confused and smudgy mass. On the other hand, if it does not occur at all we may have a hard image, a picture, in fact, of the sort and whitewash type. We require, therefore, to be able to restrain these tendencies within limits and to control and guide them according to our wishes.

It was while casting about for remedies against the melting propensities of the film under certain conditions, and the colour-staining of the paper under others, that an entirely new principle

upon which to work suggested itself to us. This newer method appears in several ways to facilitate the actual preparation of the paper, and to possess distinctive advantages from the point of view of results.

It consists in sensitising the paper in the first place and then applying the gum and colour, instead of coating with a mixture of gum, colour, and sensitising agents. Very simple indeed—as simple a matter as the balancing of Columbus' egg—but we think that it has not been noted before, or at any rate published with regard to any form of carbon printing.

The paper, then, is to be first of all soaked in a ten per cent. solution of bichromate of potash for about two minutes, rocking the dish the while, to avoid air bubbles. It is then dried (bone dry), and is ready for coating in the manner previously described, the coating mixture consisting of gum at twenty per cent. and a sufficiency of colour. We reduce the strength of the gum by one-half because it is not now so reduced by the bichromate solution.

The sensitiveness of the paper is increased to an enormous extent. Instead of being, as in the earlier system, three or four times slower than chloride or platinum paper, it is now quite as rapid as either, or as ordinary carbon tissue: even more sensitive perhaps. Unexposed, the film dissolves and leaves the paper pure, so that the edges of a print protected by the rebates of the frame are quite white, and the high lights of the picture, also, are more amenable to control. This is especially marked with black and brown pigments, which formerly were very apt to stain.

The rationale of this system would appear to be that each molecule of the pigmented gum with which the dried bichromate paper is coated absorbs, or is in contact with, just its molecule of bichromate and no more. The rest of the bichromate, protected by the coating of colour, is probably very little acted upon.

In our earliest essays on the newer system we found that the images were apt to be hard; the high lights dissolved away too

quickly and cleanly. This, however, clearly resulted from wrong proportions of the materials used, and so again, as we laid down in a preceding chapter, we shall not attempt to give an empirical formula. A very little patience and practice will teach each worker what is best for his own requirements.

The general practice is, we think, rendered more easy. We may now sensitise as many sheets of paper as we like in advance, we can keep our colours mixed with water in any quantity, and have only to add, as required, in equal proportions, gum solution of the desired strength (i.e., at about 40 per cent.) There is in this way also, far less waste. The results appear to be much more certain, and if we remember how very sensitive the film is and that where formerly, perhaps, four actinometer tints were required, less than one will suffice, failures will not so often occur.

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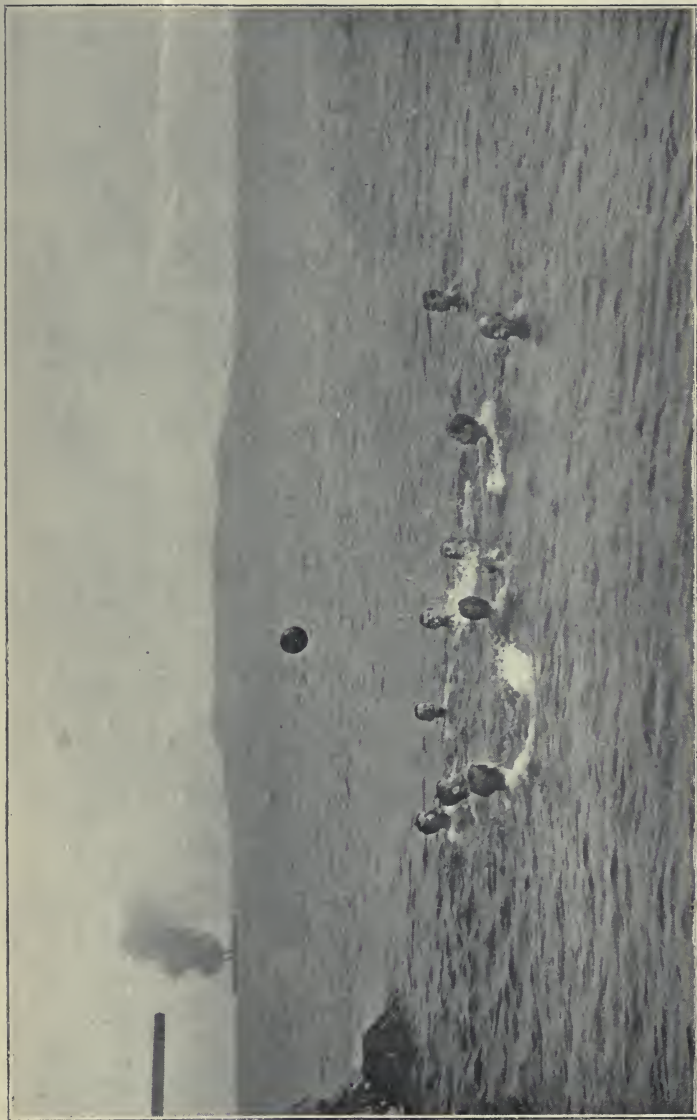
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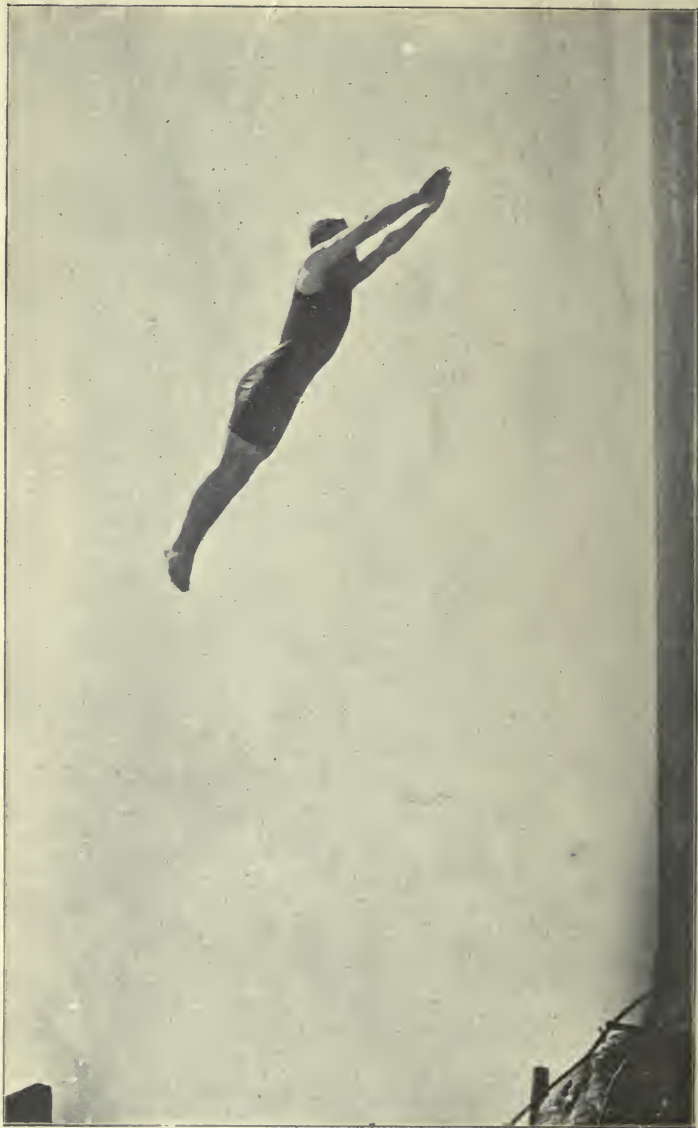
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